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B2 electroplating composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds having a molecular weight of about 1000 or less and that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition.

Please add the following new claims.

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59. A microchip wafer electroplating system comprising:
a microchip wafer substrate having microvias or trenches,
the microchip wafer substrate disposed for electroplating in a copper electroplating composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds having a molecular of about 1000 or less and that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition.
60. The system of claim 59 wherein the microchip wafer substrate is electrically attached to a cathode of the system.
61. The system of claim 59 wherein the brightener concentration is at least about 2 mg per liter of the electroplating composition.
62. The system of claim 59 wherein the brightener concentration is at least about 3 mg per liter of the electroplating composition.
63. The system of claim 59 wherein the brightener concentration is at least about 4 mg per liter of the electroplating composition.
64. The system of claim 59 wherein the brightener concentration is at least about 5 mg per liter of the electroplating composition.

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65. The system of claim 59 wherein the brightener concentration is at least about 6 mg per liter of the electroplating composition.

66. The system of claim 59 wherein the brightener concentration is at least about 8 mg per liter of the electroplating composition.

67. The system of claim 59 wherein the brightener concentration is at least about 10 mg per liter of the electroplating composition.

68. The system of claim 59 wherein the brightener concentration is at least about 15 mg per liter of the electroplating composition.

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69. The system of claim 59 wherein the electroplating composition further comprises a suppressor agent.

70. The system of claim 69 wherein the suppressor agent is a polyether.

71. The system of claim 59 wherein the electroplating composition comprises a halide ion source.

72. The system of claim 71 wherein the halide ion source is present in a concentration of from about 25 to about 75 ppm of the electroplating concentration.

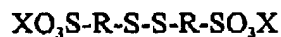
73. A microchip wafer electroplating system comprising:
a microchip wafer substrate having microvias or trenches,
the microchip wafer substrate disposed for electroplating in a copper electroplating

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composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition,

wherein the one or more brightener compounds comprise a group of the formula $R'-S-R-SO_3X$ where R is optionally substituted alkyl, optionally substituted heteroalkyl, optionally substituted aryl or optionally substituted heteroalicyclic; and X is a counter ion.

74. The system of claim 73 wherein the one or more brighteners correspond to one of the following formulas:



wherein R is optionally substituted alkyl; Ar is optionally substituted aryl; and X is a counter ion.

75. The system of claim 73 wherein the one or more brighteners are selected from the group consisting of n,n-dimethyl-dithiocarbamic acid-(3-sulfopropyl)ester; 3-mercapto-propylsulfonic acid; carbonic acid-dithio-o-ethyl-s-ester with 3-mercapto-1-propane sulfonic acid; bisulfopropyl disulfide; 3-(benzthiazolyl-s-thio)propyl sulfonic acid; and 3-mercaptopropane-1-sulfonate.

76. The system of claim 73 wherein the one or more brighteners are each a bisulfopropyl disulfide compound.

77. The system of claim 73 the one or more brightener compounds have a molecular weight of about 1000 or less.

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78. The system of claim 73 wherein the microchip wafer substrate is electrically attached to a cathode of the system.

79. The system of claim 73 wherein the brightener concentration is at least about 2 mg per liter of the electroplating composition.

80. The system of claim 73 wherein the brightener concentration is at least about 3 mg per liter of the electroplating composition.

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81. The system of claim 73 wherein the brightener concentration is at least about 4 mg per liter of the electroplating composition.

82. The system of claim 73 wherein the brightener concentration is at least about 5 mg per liter of the electroplating composition.

83. The system of claim 73 wherein the brightener concentration is at least about 6 mg per liter of the electroplating composition.

84. The system of claim 73 wherein the brightener concentration is at least about 8 mg per liter of the electroplating composition.

85. The system of claim 73 wherein the brightener concentration is at least about 10 mg per liter of the electroplating composition.

86. The system of claim 73 wherein the brightener concentration is at least about 15 mg per liter of the electroplating composition.

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87. The system of claim 73 wherein the electroplating composition further comprises a suppressor agent.

88. The system of claim 87 wherein the suppressor agent is a polyether.

89. The system of claim 73 wherein the electroplating composition comprises a halide ion source.

90. The system of claim 89 wherein the halide ion source is present in a concentration of from about 25 to about 75 ppm of the electroplating concentration.

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91. An article of manufacture comprising:
a semiconductor microchip wafer substrate having one or more microvias or trenches,
one or more microvias or trenches of the wafer substrate in contact with an electroplating composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds having a molecular weight of about 1000 or less and that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition.

92. The article of claim 91 wherein the microchip wafer substrate is electrically attached to a cathode of the system.

93. The article of claim 91 wherein the brightener concentration is at least about 2 mg per liter of the electroplating composition.

94. The article of claim 91 wherein the brightener concentration is at least about 3 mg per liter of the electroplating composition.

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95. The article of claim 91 wherein the brightener concentration is at least about 4 mg per liter of the electroplating composition.

96. The article of claim 91 wherein the brightener concentration is at least about 5 mg per liter of the electroplating composition.

97. The article of claim 91 wherein the brightener concentration is at least about 6 mg per liter of the electroplating composition.

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98. The article of claim 91 wherein the brightener concentration is at least about 8 mg per liter of the electroplating composition.

99. The article of claim 91 wherein the brightener concentration is at least about 10 mg per liter of the electroplating composition.

100. The article of claim 91 wherein the brightener concentration is at least about 15 mg per liter of the electroplating composition.

101. The article of claim 91 wherein the electroplating composition further comprises a suppressor agent.

102. The article of claim 101 wherein the suppressor agent is a polyether.

103. The article of claim 91 wherein the electroplating composition comprises a halide ion source.

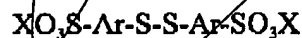
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104. The article of claim 91 wherein the halide ion source is present in a concentration of from about 25 to about 75 ppm of the electroplating concentration.

105. An article of manufacture comprising:
a semiconductor microchip wafer substrate having one or more microvias or trenches,
one or more microvias or trenches of the wafer substrate in contact with an electroplating composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition,

wherein the one or more brightener compounds comprise a group of the formula $R'-S-R-SO_3X$ where R is optionally substituted alkyl, optionally substituted heteroalkyl, optionally substituted aryl or optionally substituted heterocyclic; and X is a counter ion.

106. The article of claim 105 wherein the one or more brighteners correspond to one of the following formulae:



wherein R is optionally substituted alkyl; Ar is optionally substituted aryl; and X is a counter ion.

107. The article of claim 105 wherein the one or more brighteners are selected from the group consisting of n,n-dimethyl-dithiocarbamic acid-(3-sulfopropyl)ester; 3-mercapto-propylsulfonic acid; carbonic acid-dithio-o-ethyl-s-ester with 3-mercapto-1-propane sulfonic acid; bisulfopropyl disulfide; 3-(benzthiazolyl-s-thio)propyl sulfonic acid; and 3-mercaptopropane-1-sulfonate.

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108. The article of claim 105 wherein the one or more brighteners are each a bisulfopropyl disulfide compound.

109. The article of claim 105 wherein the microchip wafer substrate is electrically attached to a cathode of the system.

110. The article of claim 105 wherein the microchip wafer substrate is electrically attached to a cathode of the system.

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111. The article of claim 105 wherein the brightener concentration is at least about 2 mg per liter of the electroplating composition.

112. The article of claim 105 wherein the brightener concentration is at least about 3 mg per liter of the electroplating composition.

113. The article of claim 105 wherein the brightener concentration is at least about 4 mg per liter of the electroplating composition.

114. The article of claim 105 wherein the brightener concentration is at least about 5 mg per liter of the electroplating composition.

115. The article of claim 105 wherein the brightener concentration is at least about 6 mg per liter of the electroplating composition.

116. The article of claim 105 wherein the brightener concentration is at least about 8 mg per liter of the electroplating composition.

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117. The article of claim 105 wherein the brightener concentration is at least about 10 mg per liter of the electroplating composition.

118. The article of claim 105 wherein the brightener concentration is at least about 15 mg per liter of the electroplating composition.

119. The article of claim 105 wherein the electroplating composition further comprises a suppressor agent.

120. The article of claim 119 wherein the suppressor agent is a polyether.

121. The article of claim 105 wherein the electroplating composition comprises a halide ion source.

122. The article of claim 121 wherein the halide ion source is present in a concentration of from about 25 to about 75 ppm of the electroplating concentration.

123. The article of claim 105 wherein the microchip wafer substrate is immersed in the electroplating composition.

124. A method for plating a semiconductor microchip wafer substrate, comprising:
electrolytically depositing copper onto a semiconductor microchip wafer substrate having microvias or trenches from an electroplating composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds having a molecular weight of about 1000 or less and that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition.

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125. The method of claim 124 wherein the brightener concentration is at least about 2 mg per liter of the electroplating composition.

126. The method of claim 124 wherein the brightener concentration is at least about 3 mg per liter of the electroplating composition.

127. The method of claim 124 wherein the brightener concentration is at least about 4 mg per liter of the electroplating composition.

128. The method of claim 124 wherein the brightener concentration is at least about 5 mg per liter of the electroplating composition.

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129. The method of claim 124 wherein the brightener concentration is at least about 6 mg per liter of the electroplating composition.

130. The method of claim 124 wherein the brightener concentration is at least about 8 mg per liter of the electroplating composition.

131. The method of claim 124 wherein the brightener concentration is at least about 10 mg per liter of the electroplating composition.

132. The method of claim 124 wherein the brightener concentration is at least about 15 mg per liter of the electroplating composition.

133. The method of claim 124 wherein the electroplating composition further comprises a suppressor agent.

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134. The method of claim 133 wherein the suppressor agent is a polyether.

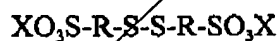
135. The method of claim 124 wherein the electroplating composition comprises a halide ion source.

136. The method of claim 124 wherein the microchip wafer substrate is electrically attached to a cathode of the system.

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137. A method for plating a semiconductor microchip wafer substrate, comprising: electrolytically depositing copper onto a semiconductor microchip wafer substrate having microvias or trenches from an electroplating composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds present in a concentration of at least about 1.5 mg per liter of the electroplating composition,

wherein the one or more brightener compounds comprise a group of the formula $R'-S-R-SO_3X$ where R is optionally substituted alkyl, optionally substituted heteroalkyl, optionally substituted aryl or optionally substituted heterocyclic; and X is a counter ion.

138. The article of claim 137 wherein the one or more brighteners correspond to one of the following formulae:



wherein R is optionally substituted alkyl; Ar is optionally substituted aryl; and X is a counter ion.

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Shbcl 139. The article of claim 137 wherein the one or more brighteners are selected from the group consisting of n,n-dimethyl-dithiocarbamic acid-(3-sulfopropyl)ester; 3-mercapto-propylsulfonic acid; carbonic acid-dithio-o-ethyl-s-ester with 3-mercapto-1-propane sulfonic acid; bisulfopropyl disulfide; 3-(benzthiazolyl-s-thio)propyl sulfonic acid; and 3-mercaptopropane-1-sulfonate.

140. The method of claim 137 wherein the one or more brighteners are a bisulfopropyl disulfide compound.

141. The method of claim 137 the one or more brightener compounds have a molecular weight of about 1000 or less.

B3 142. The method of claim 137 wherein the brightener concentration is at least about 2 mg per liter of the electroplating composition.

143. The method of claim 137 wherein the brightener concentration is at least about 3 mg per liter of the electroplating composition.

144. The method of claim 137 wherein the brightener concentration is at least about 4 mg per liter of the electroplating composition.

145. The method of claim 137 wherein the brightener concentration is at least about 5 mg per liter of the electroplating composition.

146. The method of claim 137 wherein the brightener concentration is at least about 6 mg per liter of the electroplating composition.

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147. The method of claim 137 wherein the brightener concentration is at least about 8 mg per liter of the electroplating composition.

148. The method of claim 137 wherein the brightener concentration is at least about 10 mg per liter of the electroplating composition.

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149. The method of claim 137 wherein the brightener concentration is at least about 15 mg per liter of the electroplating composition.

150. The method of claim 137 wherein the electroplating composition further comprises a suppressor agent.

151. The method of claim 150 wherein the suppressor agent is a polyether.

152. The method of claim 137 wherein the electroplating composition comprises a halide ion source.

153. The method of claim 137 wherein the microchip wafer substrate is electrically attached to a cathode of the system.

REMARKS

Claims 21-23 have been cancelled without prejudice, claims 28 and 51 have been amended, and claims 59-153 have been added. No new matter has been added by virtue of the new claims. For instance, support for the amendments of claims 28 and 51 appears e.g. on page 9, lines 2-4 of the application. Support for the new claims appears e.g. on page 4, lines 12-13; page 9, line 1 through page 10, line 12; the examples; and the original claims of the application.